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Description of the Proposed Action and Alternatives

National Test Bed Communications Network

July 1989

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Prepared for

National Test Bed Joint Program Office

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1.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES (DOPAA)

1.1 BACKGROUND

1.1.1 Introduction

The President's Strategic Defense Initiative (SDI), announced on March 23, 1983, initiated an extensive research program to determine the feasibility of developing an effective ballistic missile defense system. Subsequently, the Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, direct, and enhance the research and testing of strategic defense technologies. Future implementation of a strategic defense system would be based, in large part, on the SDIO research program.

The National Test Bed (NTB) and National Test Facility (NTF) are key elements of the SDIO's plans to conduct tests and experiments. The National Test Bed Joint Program Office (NTBJPO) was established by the SDIO to coordinate all development and acquisition of the facilities required to implement the NTB program. The purpose of this document is to provide the SDIO and NTBJPO with a description of the communications system required to link the network of NTB facilities to the NTF. This DOPAA was prepared as part of the SDIO Environmental Impact Analysis Process (EIAP) described in the SDIO EIAP framework document of September 1987. The relationship between the SDIO EIAP and the systems acquisition process (see section 1.1.3) is shown in Figure 1.1-1.

1.1.2 SDI Technology Verification Strategy

SDI is a research program. Central to the conduct of the required research is the SDI Technology Verification Strategy (see Figure 1.1-2). This strategy permits the examination, evaluation, and validation of various defense technologies in the context of defense system architectures. Numerous configurations of weapons, sensors, and Battle Management/Command, Control, and Communications (BM/C^3) systems will be simulated against a variety of threat scenarios. In this context, a "simulation" is defined as the execution of one or more software programs for the express purpose of predicting the performance of the components of the Strategic Defense System (SDS). These simulations will incorporate the expected performance of system elements explored in the SDI Technology Research Program.

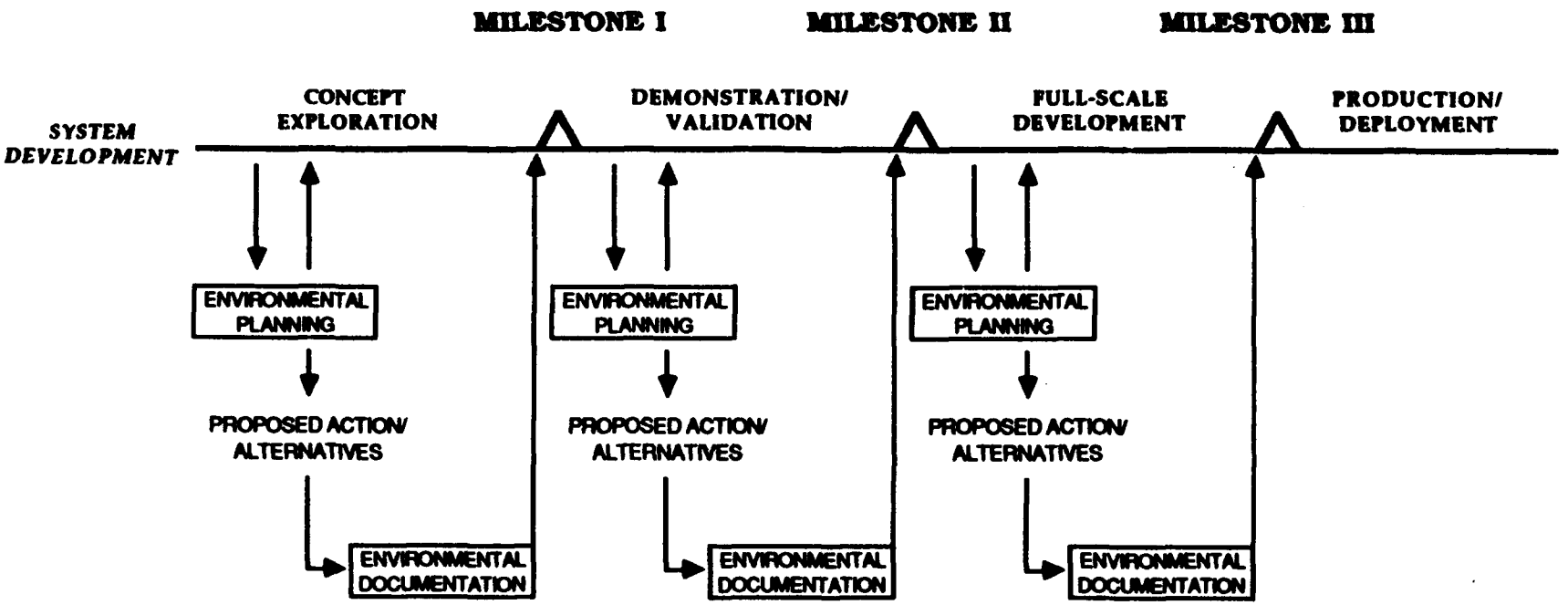

Figure 1.1-1

SDIO EIAP AND SYSTEM DEVELOPMENT INTERFACE

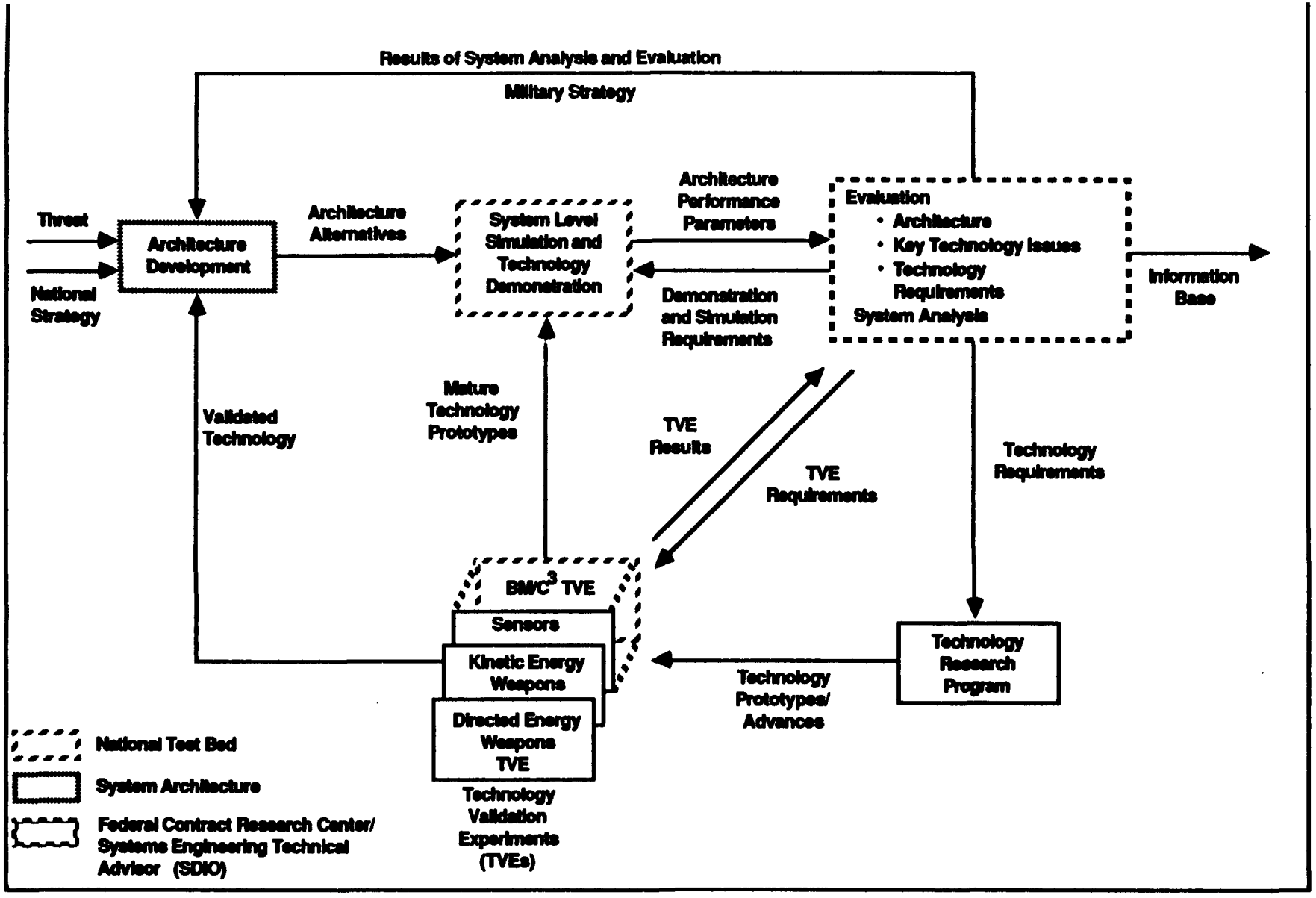

Figure 1.1-2

SDI TECHNOLOGY VERIFICATION STRATEGY

1.1.3 SDI Technology Research Program

The SDI Technology Research Program is being conducted in areas of kinetic energy weapons, directed energy weapons, sensors, BM/C^3, transportation, and supportability. In each research area, technology validation experiments (TVEs) are being undertaken to assess the performance of the different technologies. A TVE is any scientific or developmental engineering test of hardware or software conducted for the express purpose of validating hypotheses, demonstrating capabilities, or evaluating the capabilities of something new. Individual TVEs may focus on one or more elements of the SDS, ranging from the component level to integrated systems, and the elements being addressed in each experiment would generally be prototypical (e.g., brassboards, mockups, or development models). Other elements may or may not be simulated.

The acquisition process for technologies in each of the areas described above is divided into four phases: (1) concept exploration, (2) demonstration and validation, (3) full-scale development, and (4) production and deployment (see Figure 1.1-3). The process is designed to ensure that succeeding phases are not entered until there is a high probability of their success. The decision points for proceeding from one phase to the next are called "milestones," and the "milestone" decisions are made by the Defense Acquisition Board (DAB) of the Department of Defense (DOD). Having passed the DAB Milestone I review, specific technologies that have entered the demonstration and validation phase include the Boost Surveillance and Tracking System (BSTS), the Space-based Surveillance and Tracking System (SSTS), the Ground-based Surveillance and Tracking System (GSTS), the Space-based Interceptor (SBI), the Exoatmospheric Reentry Vehicle Interceptor System (ERIS), and the BM/C^3 system. These technologies are considered candidates for Phase I of the SDS.

1.1.4 National Test Bed

The SDI-system architecture and SDI Technology Research Program are functionally integrated through the NTB. The NTB is best characterized as a network or organization, rather than a single physical entity. The NTB represents a composite of hardware, software, facilities, and personnel at multiple locations dedicated to support analyses and experimentation under the SDI Technology Verification Strategy. Conceptually, the NTB would provide the coordination required to link research and experiments together, even though these experiments may be occurring at several locations throughout the world. The NTB would

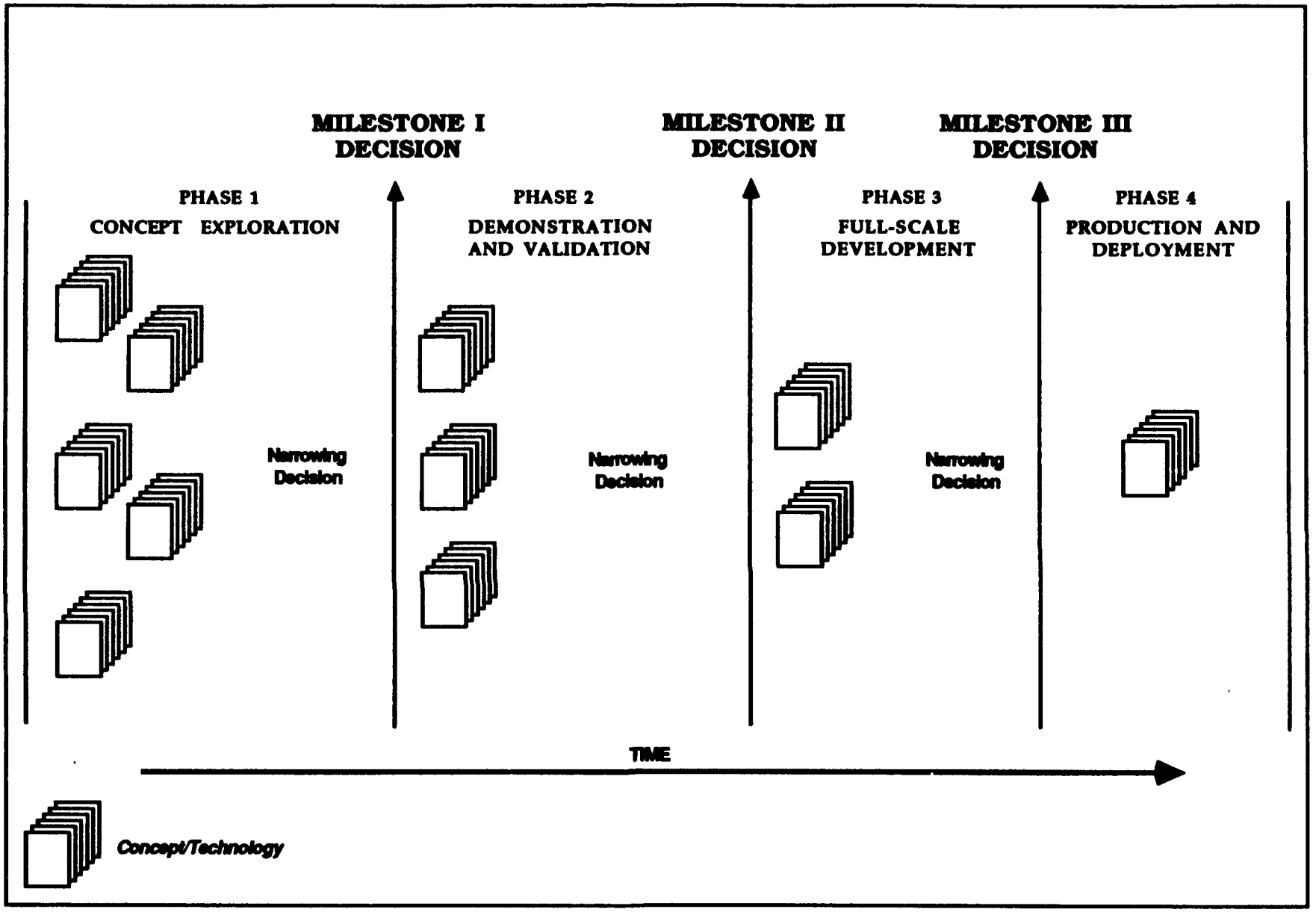

Figure 1.1-3

DEFENSE SYSTEMS ACQUISITION PROCESS

interconnect Army, Navy, Air Force, and other national test, development, evaluation, and demonstration facilities into a single, distributed SDI resource. This interconnection would provide the SDIO and NTBJPO with a comprehensive capability to independently test, validate, and verify candidate defense technologies and alternative SDI systems and BM/C^3 architectures.

The facilities constituting the NTB would include existing test ranges, laboratories, and contractor facilities that could provide the necessary testing environment for hardware experiments. The facilities participating in the NTB at any given time would vary depending on the nature of the experiments and the issues being addressed. NTB facilities would provide the capability to host BM/C^3 TVEs and integrate TVEs in simulations to verify adequacy in ballistic missile defense. The facilities addressed in this DOPAA form a portion of the NTB; other sites will become involved in the NTB as the program becomes further defined (see Figure 1.1-4). New sites will be addressed in amendments to this DOPAA, as required.

1.1.4.1 Purpose and Need for the NTB

The NTB will provide a comprehensive capability to compare, evaluate and test alternative system and BM/C^3 architectures for defense against ballistic missiles, as well as evaluate various defensive technologies in a system framework. The NTB's primary purpose is to provide information to the SDIO that will enable an informed decision on moving to full scale development in the major weapon system acquisition process. Within the parameters of this mission, a number of sub-missions are defined. These affect establishing initial hardware, software and personnel resource requirements for the NTB and the NTF. They include the requirements to:

- Host and execute simulations of SDIO-provided strategic defense architectures at the NTF.
- Conduct analyses of existing simulations available from both government and industry.
- Provide standard threat, environment, tactical warning system and National Command Authority interface characteristics.
- Host selected end-to-end strategic defense simulations on NTB equipment.

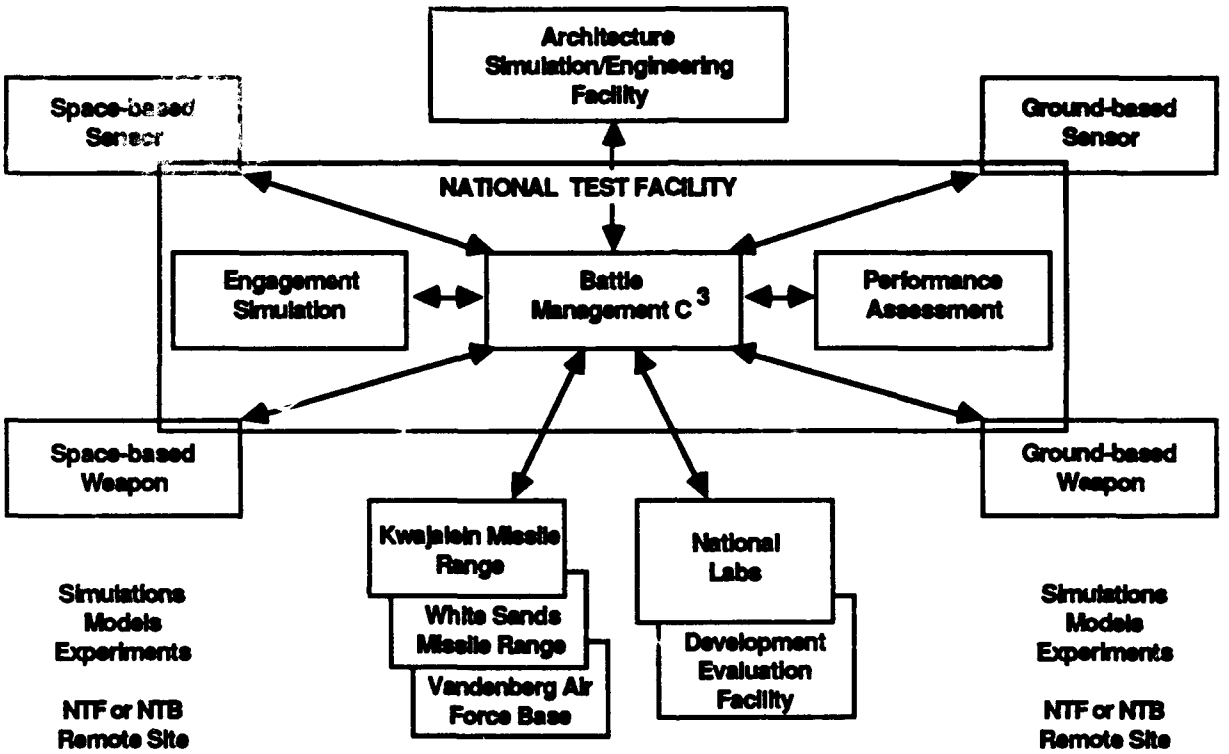

Figure 1.1-4

NTB FACILITIES CONCEPT

- o Conduct simulations and demonstrations of various SDI components.

- o Support or conduct SDIO-sponsored military service and joint service/agency experiments.

- o Provide a repository for SDI reference data, including a standard data base of simulation and supporting performance data.

- o Plan, analyze and implement requirements for evolution of the NTF and NTB.

1.1.5 NTB Facility Construction Activities

1.1.5.1 Falcon Air Force Base

A new permanent NTB Operations Building is under construction at Falcon Air Force Base (FAFB) near Colorado Springs, Colorado. This building will house the various computing systems and communications equipment that will form the National Test Facility. This computer complex will support simulations, software testing and integration, and networking of NTB test facilities participating in TVEs. The NTF is the central control and coordinating facility -- the core -- for the NTB. NTF functions essential to implementing the SDI Technology Verification strategy will include:

- o A high-fidelity/resolution system and BM/C^3 simulations.

- o Conduct and control of large-scale BM/C^3 experiments.

- o Storage of SDI reference data, including a standard database of simulation and supporting performance data.

- o Integration and control of TVEs.

- o Documentation and assessment of simulations, demonstrations and experiment results.

- o Maintenance of order and control of models, and real-time, man-in-the-loop software development simulations.

A temporary building, consisting of pre-fabricated sections built on trailers, houses the National Test Bed Joint Program Office (NTBJPO) and National Test Bed Integration Contractor (NTBIC) personnel. Currently, this modular facility also partially houses the computing systems and communications equipment that constitute the Interim NTF capability. The remainder of the equipment completing this interim capability is housed in a limited area of the already existing Consolidated Space Operations Center Operations Building.

A NTB Engineering and Administrative Building is planned for construction next to the NTB Operations Building. When constructed, it will house the NTBJPO and NTBIC, replacing the modular facility.

Also included in the NTF Complex is a new Pass and ID Building, a new entry control facility and modifications to the existing central plant.

1.1.5.2 NTB Communications Connectivity Facilities

The geographically distributed NTB facilities will be linked through a communications network. This network will consist of telecommunications via satellite earth stations and land lines. Details of this communications architecture are contained in later sections of this document. In some cases, satellite earth stations already exist at the facilities involved. There, no new construction activities are planned. For new installations, concrete pads will be poured, power and heating will be installed, and data cables will be provided to connect the earth station to its applicable tail circuits. Fire and security alarms will be installed, and landscaping will be accomplished, where applicable.

1.1.5.3 Video-Teleconferencing Facilities

To support the SDIO, video-teleconferencing facilities have been built at key locations throughout the United States. They are located at the SDIO in Washington, D.C., Electronic Systems Division at Hanscom Air Force Base, MA, Rome Air Development Center, Rome, NY, Strategic Defense Command, Huntsville, AL, Lawrence Livermore National Laboratory, CA, Space Division, Los Angeles, CA, Los Alamos National Laboratories, NM, the Air Force Space Test Center, NM, and Falcon Air Force Base, CO. At all locations, except Lawrence Livermore, space in already existing buildings was used to house the studio. At Lawrence Livermore, a new building was constructed on Lawrence Livermore property as no adequate existing space could be found.

1.1.6 Existing Environmental Documentation

NTB developmental activities have required environmental documentation to ensure compliance with the National Environmental Policy Act and the Council on Environmental Quality regulations. The status of environmental documentation required for construction and system operations is as follows:

- An Environmental Assessment (EA) for the construction of the NTF has been accomplished. The study resulted in a Finding of No Significant Impact (FONSI).

- The installation of the modular complex at Falcon Air Force Base was evaluated and categorically excluded (CATEX) in accordance with provisions in Air Force Regulation 19-2 by Headquarters, Air Force Space Command.

- An environmental evaluation is underway for the construction of the new satellite earth station located at Falcon Air Force Base, CO.

- The Navy has prepared an EA for the Waldorf, MD satellite earth station. The existing site is a Navy facility. The EA is currently being staffed within Navy channels.

- Environmental concerns were addressed for the satellite earth station being installed at the Advanced Research Center (a contractor facility) in support of the U.S. Army's Space Defense Command (USASDC). Since the earth station was not going to be located on federal property, USASDC performed no environmental work. Nevertheless, the environmental implications associated with locating an earth station at the facility were discussed with the Huntsville City Planning Board. Building permits were obtained and the Huntsville Planning Commission approved the installation.

- In accordance with Lawrence Livermore National Laboratories and Department of Energy policy at the time of building construction, no environmental work was required for the video-teleconferencing facility. All other video-teleconferencing facilities have been categorically excluded (CATEX).

1.2 PURPOSE OF THE PROPOSED ACTION

The proposed action will establish the communication linkages between NTB remote sites and the NTF. The system will allow communications interface such that the data from TVE tasks performed at NTB test facilities can be transmitted in near real time to the NTF. In addition, the NTB communications network will enable remote sites to access the computing capability resident at the NTF.

1.3 NEED FOR THE PROPOSED ACTION

The NTB communications network is necessary to integrate and synthesize experiments performed at multiple sites including remote sites. Without the communication capabilities provided by the proposed action, the SDIO and NTBJPO would not be able to independently integrate and evaluate key technologies and alternative architectures. An informed decision regarding full-scale development of the SDS would not be possible.

1.4 PROPOSED ACTION

1.4.1 Deployment and Operational Concept

The NTB network will consist of the NTF and ten Remote Access Sets (RASs). The ten RASs currently in the NTB baseline are Space Systems Division (SSD), El Segundo, CA; Los Alamos National Laboratory (LANL), Los Alamos, NM; Air Force Space Technology Center (AFSTC), Kirtland Air Force Base (AFB), NM; USASDC, Huntsville, AL; Strategic Defense Initiative Organization (SDIO), Washington, D.C.; Naval Research Laboratory (NRL), Waldorf Microwave Space Research Facility, Waldorf, MD; Foreign Technology Division (FTD), Wright-Patterson AFB, OH; General Electric Systems Engineering and Integration Facility (GE), Blue Bell, PA; Rome Air Development Center (RADC), Griffiss AFB, NY; and Electronic Systems Division (ESD), Hanscom AFB, MA. Table 1.4-1 lists and Figure 1.4-1 shows the locations of the remote sites.

The NTB remote sites that will be connected to the NTF via the communications system were chosen for their ability to perform or participate in testing and evaluation of Phase I technologies. Other operational considerations were considered less important. For example, avoidance of populated areas was not considered an important siting criterion because the antennas will pose no threat to the health and safety of the general public.

Table 1.4-1

REMOTE SITE LOCATIONS

Los Alamos National Laboratory (LANL) Los Alamos, New Mexico
Air Force Space Technology Center (AFSTC) Kirtland AFB, New Mexico
Space Development Center (SDC) Huntsville, Alabama
Electronic Systems Division (ESD) Hanscom AFB, Massachussetts
Naval Research Laboratory (NRL) Waldorf Microwave Space Research Facility Waldorf, Maryland
Rome Air Development Center (RADC) Griffiss AFB, New York
Space Systems Division (SSD) El Segundo, California
Analysis Center (ECAC)
Strategic Defense Initiative Organization (SDIO) Washington, D.C.
Foreign Technology Division (FTD) Wright-Patterson AFB, Ohio
General Electric Systems Engineering and Integration Facility (GE) Blue Bell, Pennsylvania

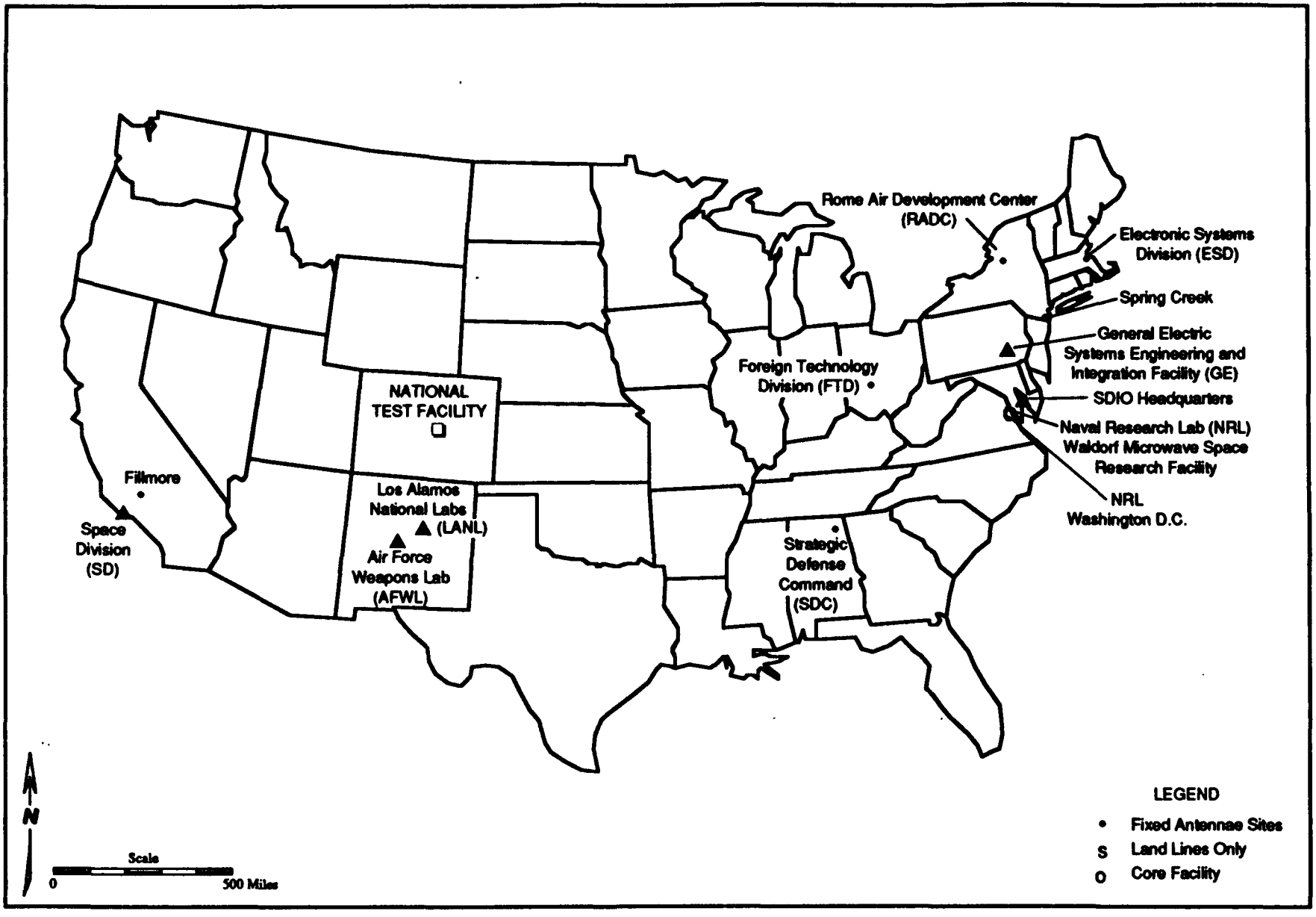

Figure 1.4-1

NTB COMMUNICATIONS NETWORK LOCATION OF REMOTE SITES

Figure 1.4-2 illustrates the NTB communications architecture. SDC will be connected with the NTF via an antenna placed at that installation. Figure 1.4-3 identifies its proposed location. SSD will utilize an existing antenna owned by Hughes Corporation (HCI) in Fillmore, California. ESD, GE, and RADC will utilize an existing antenna owned by HCI in Spring Creek, NY. SDIO, NRL, and FTD will be using an antenna built at Waldorf, MD as shown in Figure 1.4-4. The location of the antenna at the NTF is shown in Figure 1.4-5. The antennas will be able to receive and transmit messages relayed through a commercial-band satellite known as the "Galaxy II." This satellite is located over the equator and is in a geosynchronous orbit.

LANL and AFSTC will communicate with the NTF via permanent terrestrial telephone lines, and SDIO, NRL, and FTD will access the antenna at Waldorf through permanent terrestrial lines. ESD, GE, and RADC will access the antenna at Spring Creek through permanent terrestrial lines. As described in section 1.4.2.5, Sun workstations and other equipment will be located at the NRL facility in Washington, D.C., which will communicate with the NRL Waldorf facility through permanent terrestrial lines. Before the antennas become operational, SDIO, SDC, GE, and ESD will communicate with the NTF through terrestrial telephone lines. These lines, excluding SDC, will be removed at those sites where antennas are installed and rerouted to the Waldorf or Spring Creek antenna.

The antennas will initially transmit and receive messages approximately eight hours per day and could ultimately transmit and receive 24 hours a day. The amount of time that the antennas will be in use depends on the types of activities that take place at each site.

In addition to the NTB network, the SDIO has implemented a SDIO VTC Network which is independent of the NTB. The SDIO VTC Network consists of studios located at SSD, AFSTC, ESD, LANL, NTF, RADC, SDIO, USASDC, and LLNL. The studios utilize the Defense Commercial Telecommunications Network (DCTN), a service provided by American Telephone and Telegraph (AT&T), for connectivity.

1.4.2 Engineering Concept

The antennas at the remote locations will be 7.3 meters in diameter. Their maximum height will not exceed 26.9 feet. The antennas will be placed on one of two types of foundations, depending on soil conditions. Generally, antennas placed

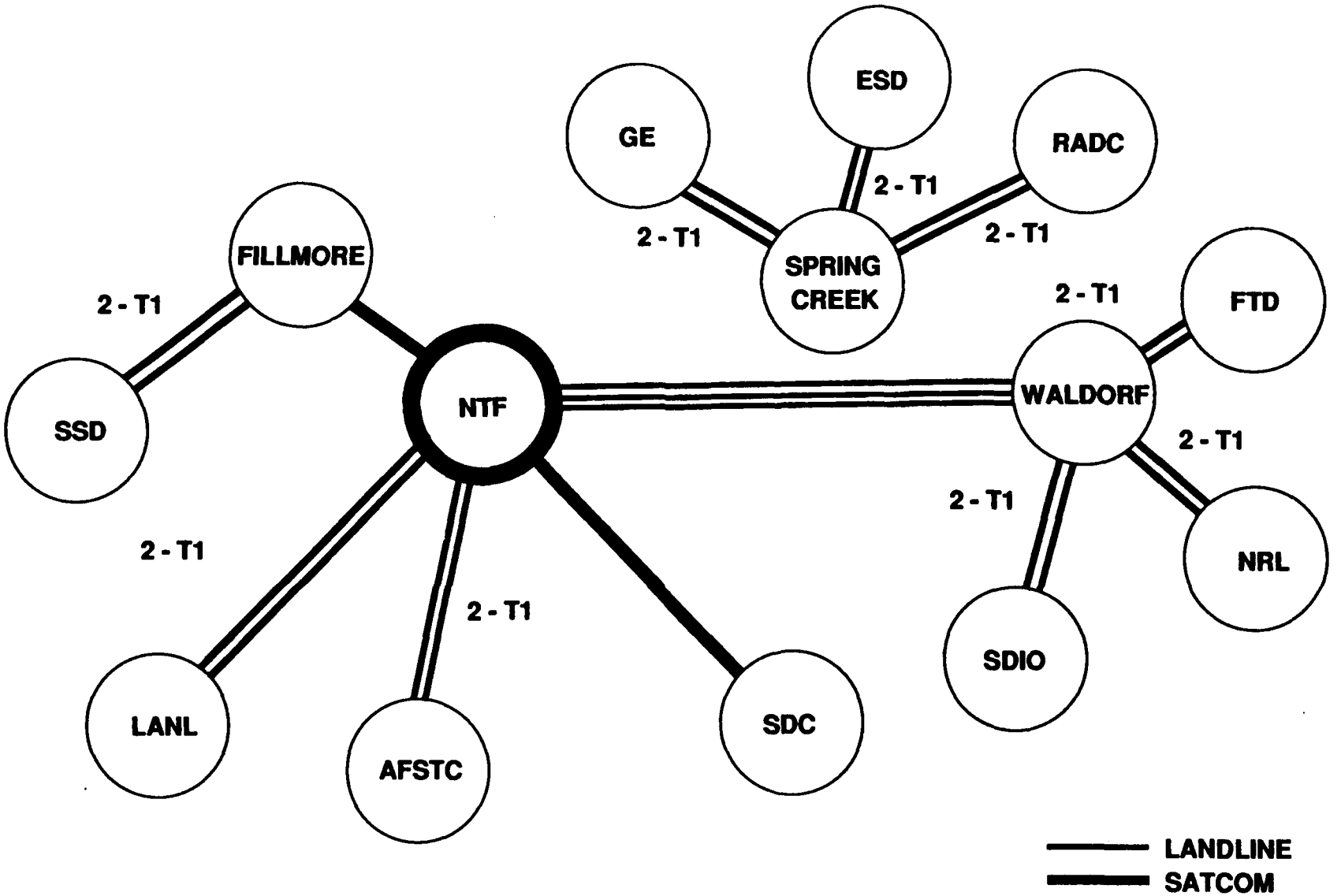

Figure 1.4-2

NTB COMMUNICATIONS ARCHITECTURE

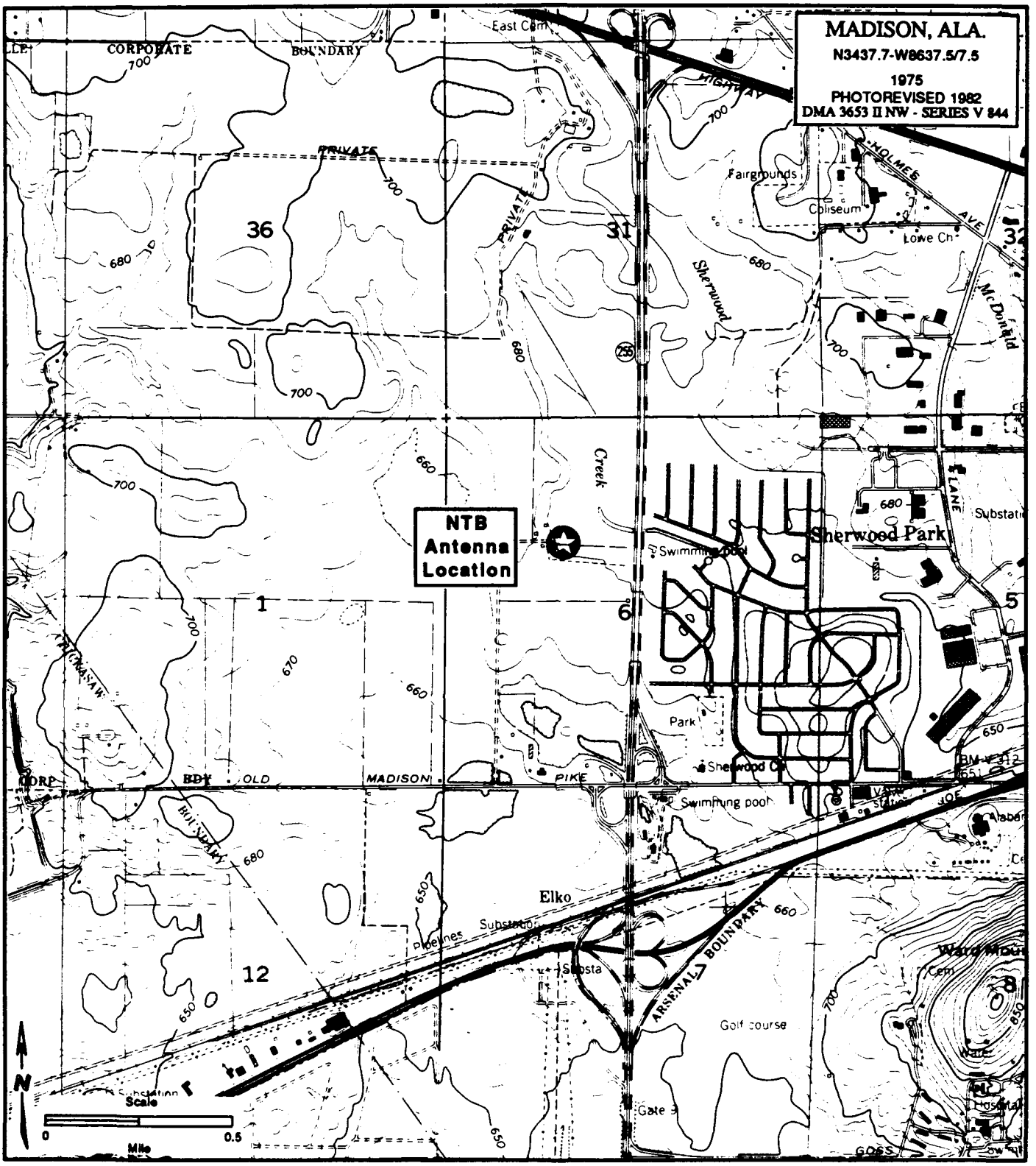

Figure 1.4-3

ANTENNA LOCATION AT U.S. ARMY STRATEGIC DEFENSE COMMAND

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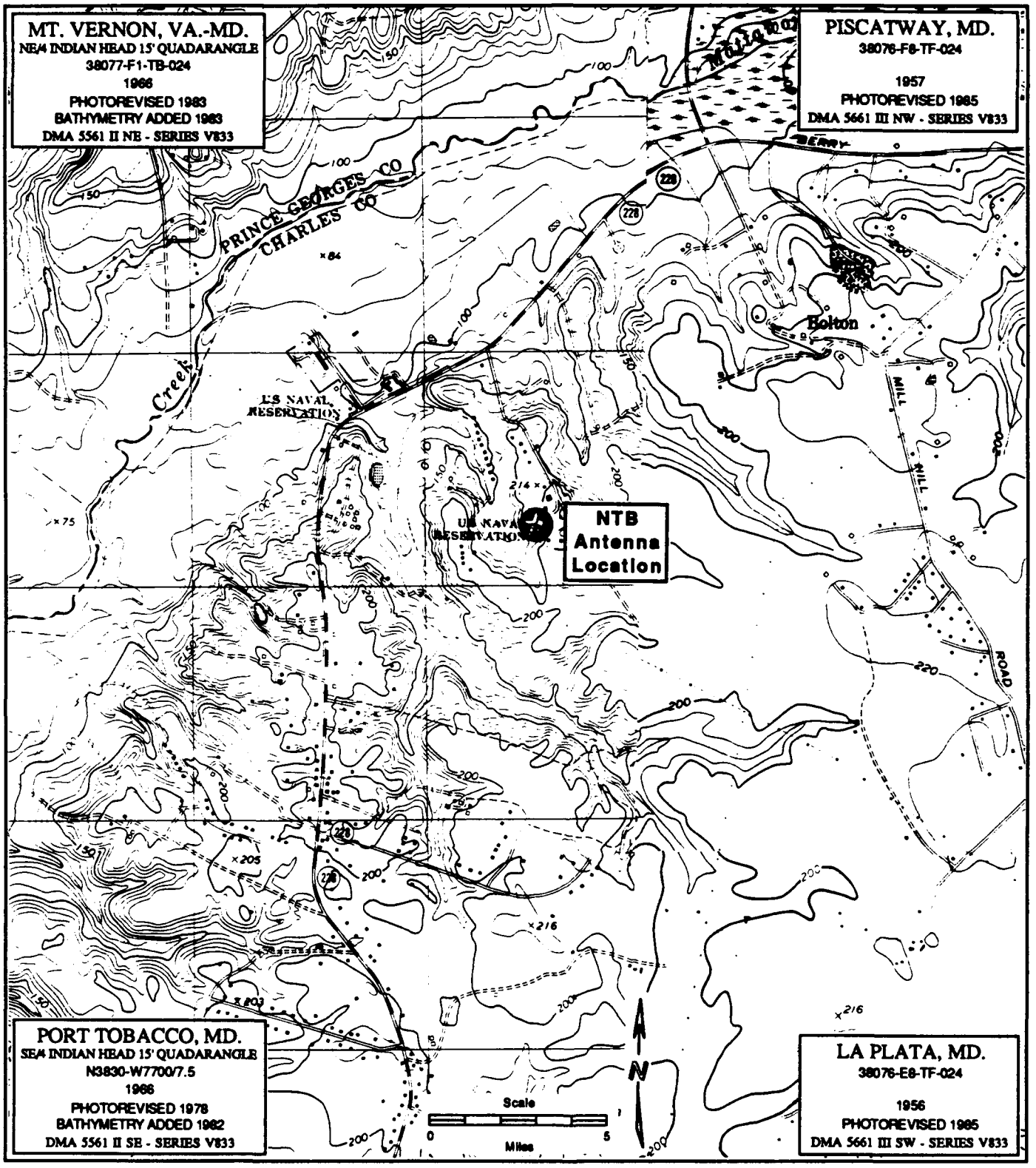

Figure 1.4-4

ANTENNA LOCATION AT NRL WALDORF MICROWAVE SPACE RESEARCH FACILITY

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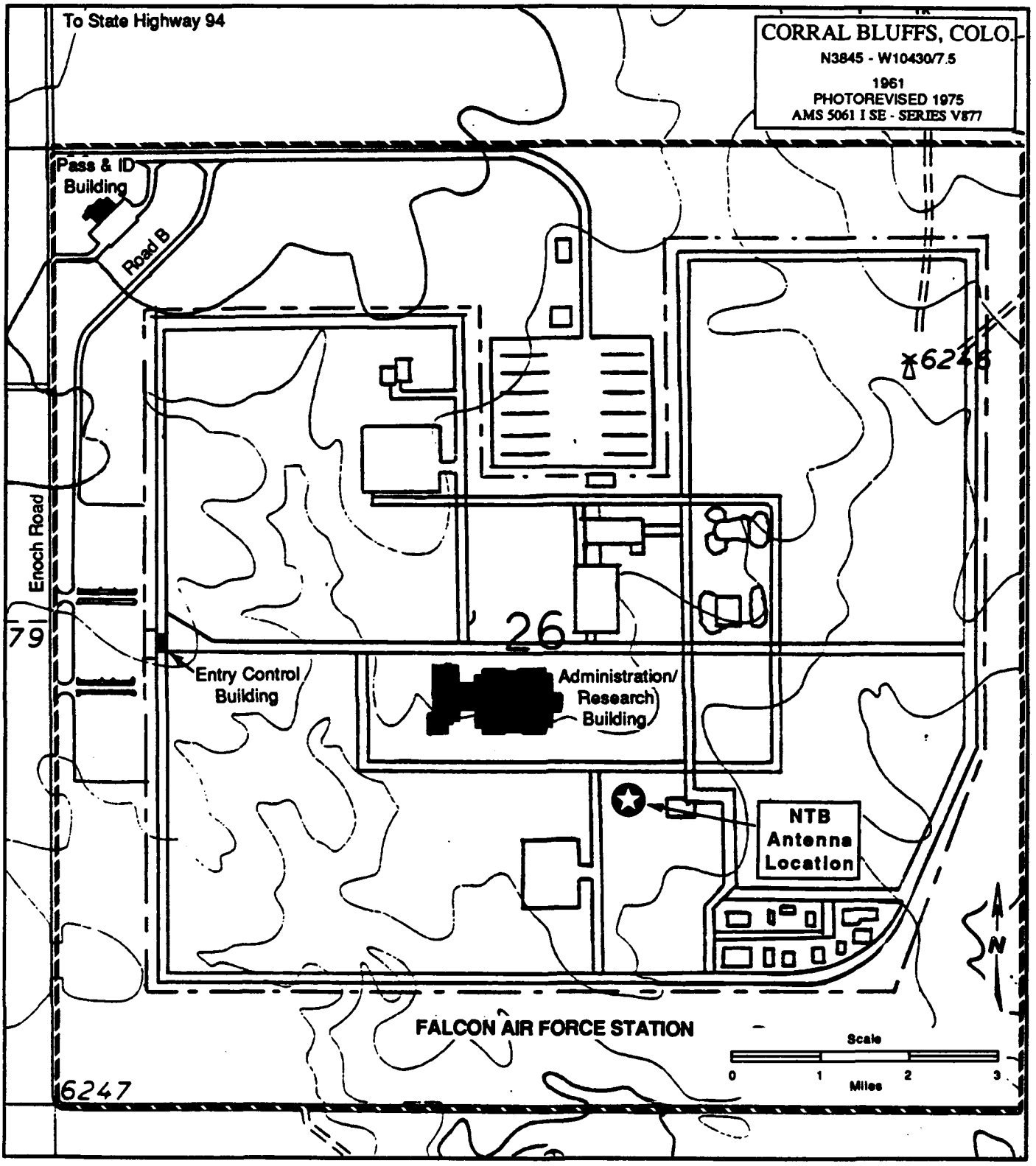

Figure 1.4-5

ANTENNA LOCATION AT NATIONAL TEST FACILITY
(Falcon Air Force Base)

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in areas with loose or unstable soils will be placed on piers that will be sunk below the ground surface to depths which will vary according to site-specific conditions. Figure 1.4-6 illustrates an antenna placed on piers. Antennas built on firm, stable soils will be constructed on 18.8-by-18.6-foot concrete pads (see Figure 1.4-7). Each pad's thickness will depend on the particular soil characteristics at individual sites but is expected to be approximately 2 feet. The depth of the excavations necessary for pad foundations will vary from site to site depending on local requirements. These pads will be large enough to support a 9.1-meter antenna if additional capacity is required in the future, although currently there are no plans for installing larger antennas at any of the remote sites. The 9.1-meter dishes will not exceed 33.6 feet in height.

Additional concrete pads, 12 feet by 6 inches long and 8 feet by 6 inches wide, will be placed at each of the sites to the rear of the antenna. The footprint of a 7.3-meter antenna pad and shelter is presented in Figure 1.4-8. The smaller pads will support a prefabricated metal structure that would house radio-frequency (RF) equipment.

A 12-meter antenna will be installed for the NTF in an existing antenna field at Falcon AFB on a 23-by-26-foot concrete pad. A smaller pad will be placed in back of the antenna, as described for the 7.3-meter dishes (see Figure 1.4-9).

Both the 7.3-meter and 12-meter antennas will receive messages transmitted in the 3.7-to-4.2-gigahertz (GHz) range and will transmit at a frequency of between 5.925 and 6.425 GHz. Two frequencies will be selected to allow for system expansion. It tentatively appears that the antennas will transmit at 6.085 GHz and 6.097 GHz and will receive at 3.860 GHz and 3.872 GHz. Frequencies selected will be based on power availability and bandwidth for the two TDMA carriers on C-band Galaxy satellites. Frequency spectrum studies assisted in selection of optimum antenna locations.

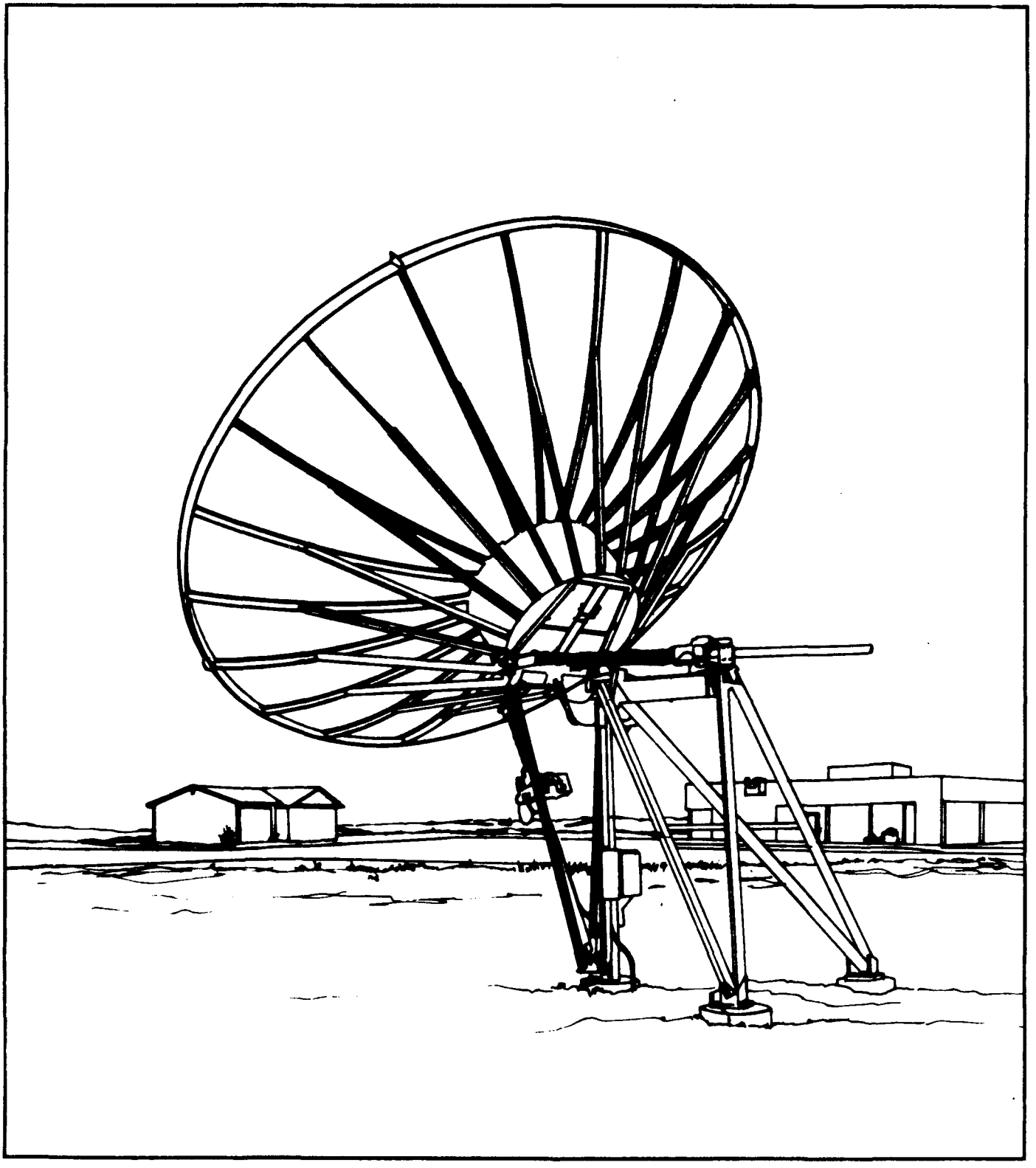


Figure 1.4-6

ANTENNA WITH CONCRETE PIERS

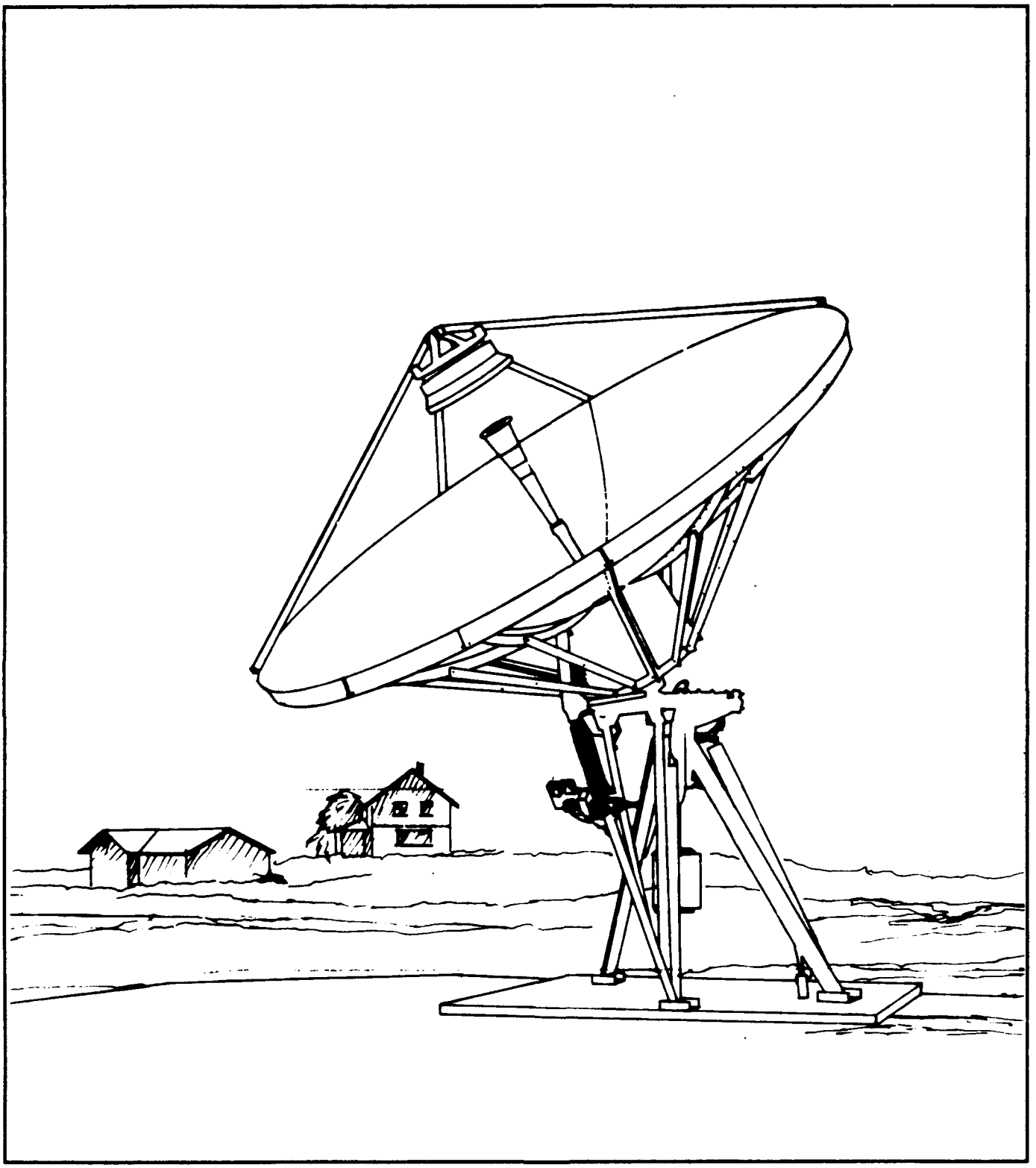


Figure 1.4-7

ANTENNA WITH CONCRETE PAD

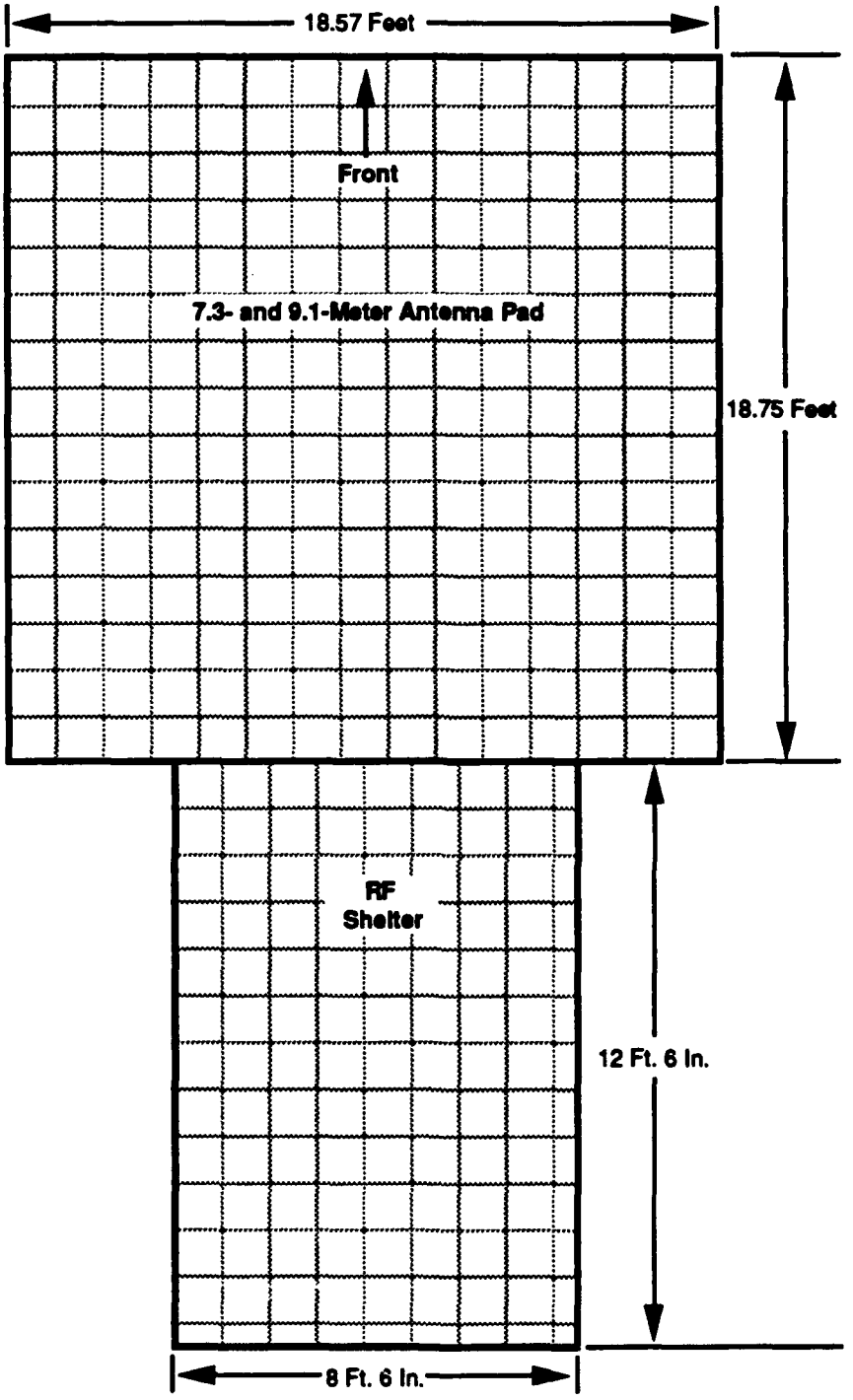


Figure 1.4-8

FOOTPRINT OF 7.3- AND 9.1-METER ANTENNA PAD

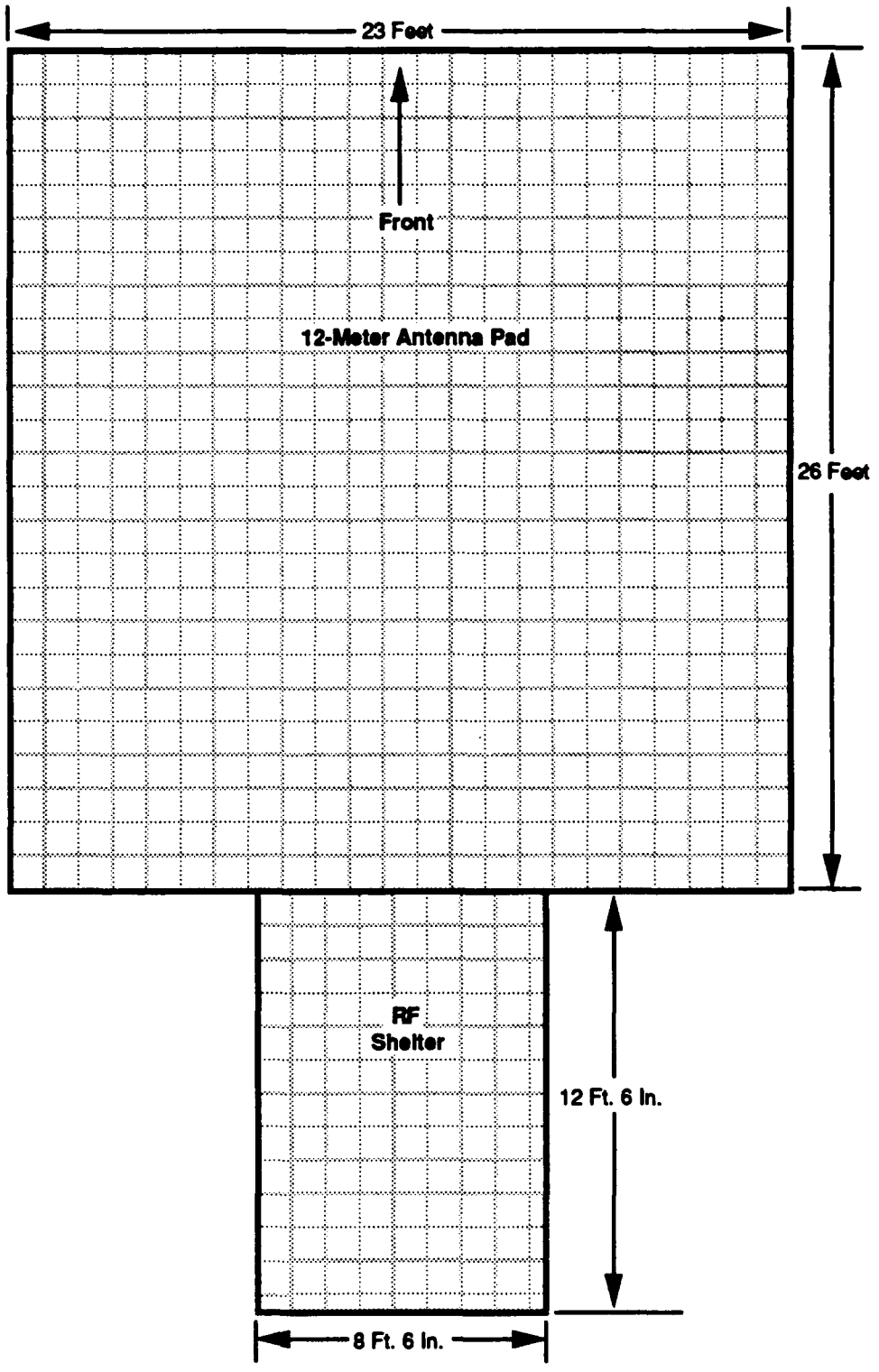


Figure 1.4-9

FOOTPRINT OF 12-METER ANTENNA PAD

Figures 1.4-10 and 1.4-11 indicate the amount of power that will be produced at varying intervals from the main beam for both the 7.3- and 12-meter antennas. A 3dB beamwidth of a parabolic antenna can be estimated by the expression:

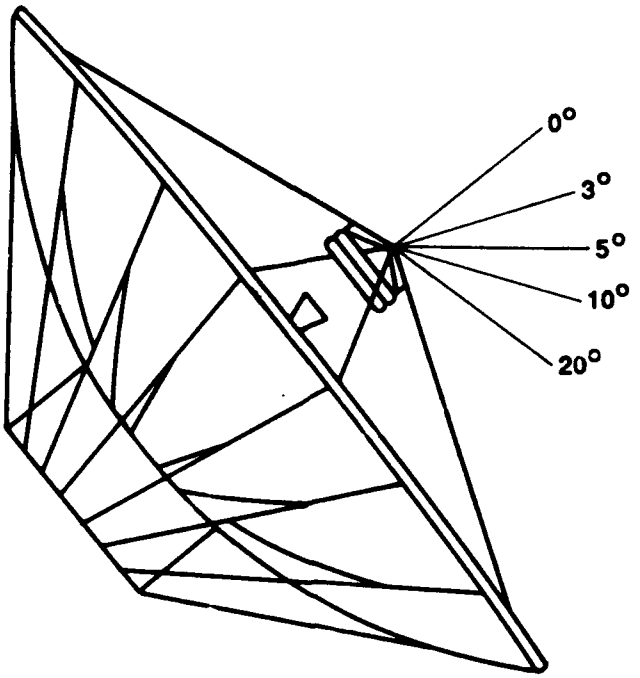
$$BW_{3dB} = 70/FD$$

where

BW_{3dB} = Antenna 3dB beamwidth, in degrees
F = Frequency, in gigahertz
D = Antenna diameter, in feet

Applying this expression to the 7.3-meter antenna over its planned transmit range (5.925-to-6.425 GHz) computes a 3dB beamwidth range of 0.49-to-0.46 degrees. For the 12-meter antenna the range is 0.3-to-0.28 degrees. A number of agencies and professional associations, as well as the state of Massachusetts, have issued guidelines concerning the exposure of workers and the general public to RF. Radiation hazard guidelines for the frequencies involved in the NTB communication network are summarized in Table 1.4-2.

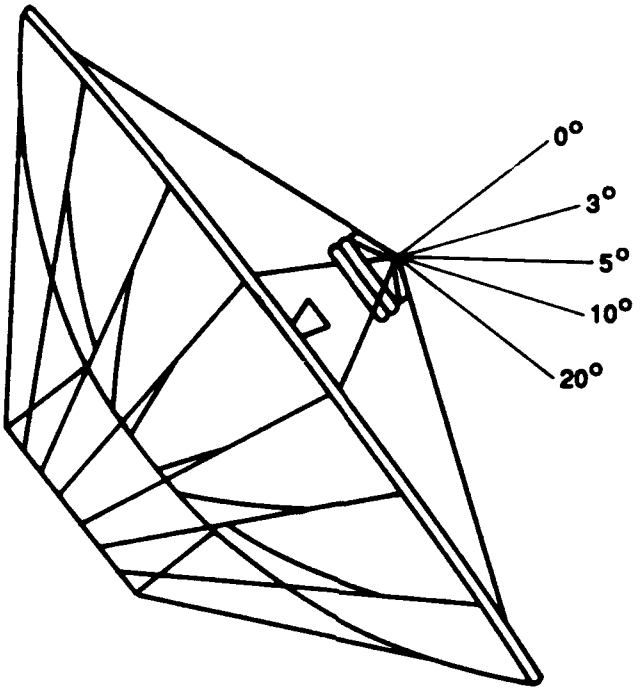
The antennas will be fixed at a 40- to 45-degree angle and directed away from any structures; no people will be present within the direct line of the beam. The 6-foot high chain-link fences that will surround the antenna pads will ensure that no unauthorized personnel will be allowed to come in contact with the antennas. Due to the concentrated nature of microwave beams, side lobes are minimal, and radiation levels drop off rapidly outside the main beam. Even at the ground immediately adjacent to the antennas, radiation levels from both the 7.3- and 12-meter antennas will not exceed the most stringent guideline of 1 milliwatt per centimeter squared (mW/cm^2), and personnel and members of the general public will not be in a field that exceeds any of the permissible exposure limits. These antennas have an expected actual output of 20 to 40 watts depending on antenna size and location. However, to make a "sure-safe" assessment, the evaluation should be based on maximum potential output. In the case of the NTB antennas, this is 125 watts. Based on evaluations required for FCC license data, the power density in the region between the reflector and the ground (P/A) can be estimated as equal to the power in watts (W) divided by the area of the reflector surface (A), assuming even illumination over the reflector.



Pointing Angle	EIRP (dBw)	Beam Width
0 Degrees	72.7	.44 Degrees
3 Degrees	38.0	
5 Degrees	32.0	
10 Degrees	19.0	
20 Degrees	11.0	

Figure 1.4-10

MAXIMUM EIRP FOR THE 7.3-METER ANTENNA



Pointing Angle	EIRP (dBw)	Beam Width
0 Degrees	77.4	24 Degrees
3 Degrees	37.0	
5 Degrees	32.0	
10 Degrees	28.0	
20 Degrees	20.0	

Figure 1.4-11

MAXIMUM EIRP FOR THE 12-METER ANTENNA

Table 1.4-2

GUIDELINES FOR HUMAN EXPOSURE TO RF IN THE 6-TO-7-GHz RANGE

Organization	*mW/cm^2*	*Application*
American National Standards Institute (ANSI)	5	General public
Occupational Health and Safety Administration (OSHA)	10	Occupational
National Council on Radiation Protection (NCRP)	1	General public
Department of Defense (DOD)	5	Occupational
International Radiation Protection Association (IRPA)	1	General public
International Radiation Protection Association (IRPA)	5	Occupational
Commonwealth of Massachussetts	1	General public

$$P/A = W/A$$

Thus:

7.3-meter antenna with 125 watts transmit power
$P/A = 125{,}000\ mW/418{,}500\ cm^2 = 0.298\ mW/cm^2 < 1\ mW/cm^2$

12-meter antenna with 125 watts transmit power
$P/A = 125{,}000\ mW/1{,}131{,}000\ cm^2 = 0.111\ mW/cm^2 < 1\ mW/cm^2$

Radiation produced by 9.1-meter antennas, if used, would not exceed that of the 12-meter antenna and would pose no health hazard.

The phone lines used will be T1 land lines. These lines are the equivalent of 24 voice lines and are capable of transmitting 1.544 megabits of information per second (mps). The antennas will originally transmit and receive 1.5 mps, although they have the capacity to handle up to 15 mps.

No water or natural gas will be required. Uninterrupted power supply (UPS) will be provided at the NTF and Waldorf sites. Power conditioning will be provided at SDC, SSD, NRL, AFWL, SDIO, ESD, FTD, RADC and G.E. Deicing equipment will be present at each of the sites. It will be powered by propane at the NTF; other sites will use electricity. The propane at the NTF will be stored in above-ground storage tanks which will be added when the antenna is installed. This system will function independently of other existing propane systems. Electrical demand will approximate 32 kilowatts (kW) at sites with 7.3-meter antennas. Sites with no antennas will require about 10 kW. The NTF will use less electricity than other antenna sites (about 12 kW), since propane will be used for deicing.

The communications and computing equipment that will be installed at the remote sites will require access to a ground of 5 ohms or less. In the event that this is unavailable at the site, adequate grounding will be provided by the NTBJPO.

Obtaining site system accreditation will be the responsibility of each installation; security will be provided in accordance with their requirements. Security will be approved by the NTBJPO and SDIO through the Security Working Group, which is organized under SDIO.

Each of the new Galaxy II C band satellite earth stations in the NTB network requires an RF assignment application before installation of any station in the

NTB network. A DD Form 1494 will be submitted for each radio frequency and modulation waveform identified for network use. The satellite earth stations included in the NTB network are: National Test Facility, Falcon Air Force Base, Colorado Springs, CO; Army Strategic Defense Command, Advanced Research Center, Huntsville, AL; Naval Research Laboratory (Waldorf, MD site); Fillmore, CA (Hughes Galaxy earth station), and Spring Creek, NY (Hughes Galaxy earth station).

The RF assignment application process is as follows:

a. The NTBIC and Host Organization at each site conduct a survey to identify the location of each new station to the nearest second of latitude and longitude. The elevation above sea level is also determined at this time.

b. The NTBIC performs an RF spectrum survey at all new station locations to identify the frequencies already in use and to determine if any frequency conflicts are present. The NTBIC then submits an application to the Federal Communications Commission (FCC) for preliminary frequency approval. Prior to submitting the spectrum survey to the FCC, a DD Form 1494 will be submitted to the NTBJPO for review and approval. The FCC normally grants preliminary RF assignment approval after favorable conclusion of the spectrum analysis. This approval is valid for six months.

c. Within the six-month period referenced above, the NTBIC will make formal application to activate the frequency assignment. If the frequency is not activated, the integration contractor must show progress in implementation or abandon the application.

The NTBIC has contracted with Spectrum Planning Inc. to perform the spectrum survey and submit initial applications. The NTBIC will be the point of contact for information on the status of any application with the FCC.

Following is a discussion of each remote site. Except where indicated, the NTBJPO will provide all equipment and be responsible for installation, maintenance, and operations. Best commercial practices will be used where no specific installation requirements are identified. Table 1.4-3 lists the equipment that will be installed at each site. Figure 1.4-12 illustrates the equipment set-up at

Table 1.4-3

EQUIPMENT TO BE INSTALLED AT EACH SATCOM HUB AND REMOTE SITE

	AFSTC	ESD	NRL	SDIO	RADC	GE	FTD	LANL	SDC	F[1]	SD	W[2]	NTF	SP[3]
CSUs	2	2	2	2	2	2	2	2	0	2	2	6	4	6
Fiberoptic MUXs	0	0	0	0	0	0	0	0	1	0	0	0	2	0
KG94As	2	2	2	2	2	2	2	2	2	0	2	0	20	0
Power supplies	2	2	2	2	2	2	2	2	2	0	2	0	20	0
Safe (2 drawer)	1	1	0	0	0	1	0	0	0	0	1	0	1	0
Crypto shredder	1	1	0	1	0	1	0	0	0	0	1	0	1	0
Safe equipment	0	1	1	0	0	1	0	0	0	0	1	0	0	0
NX4600 with system console	1	1	1	1	1	1	1	1	1	0	1	0	1	0
IB3	1	1	1	1	1	1	1	1	1	0	1	0	15	0
TDMA with WCT1000 workstation	0	0	0	0	0	0	0	0	1	1	0	1	1	1
Color Sun workstation (C3/60) with table and chair	1	1	1	1	1	--	1	1	1	--	1		--	--
Monochrome Sun workstation (M3/60) with chair	1	1	1	1	1	--	1	1	1	--	1		--	--
7.3-m satellite antenna with RF equipment shelter	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10-m satellite antenna	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12-m satellite antenna with RF equipment shelter	0	0	0	0	0	0	0	0	0	0	0	0	1	0
13-m satellite antenna	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ethernet	1	1	1	1	1	1	1	1	1	0	1	0	10	0

Note:
1. F = Fillmore
2. W = Waldorf
3. SP = Spring Creek

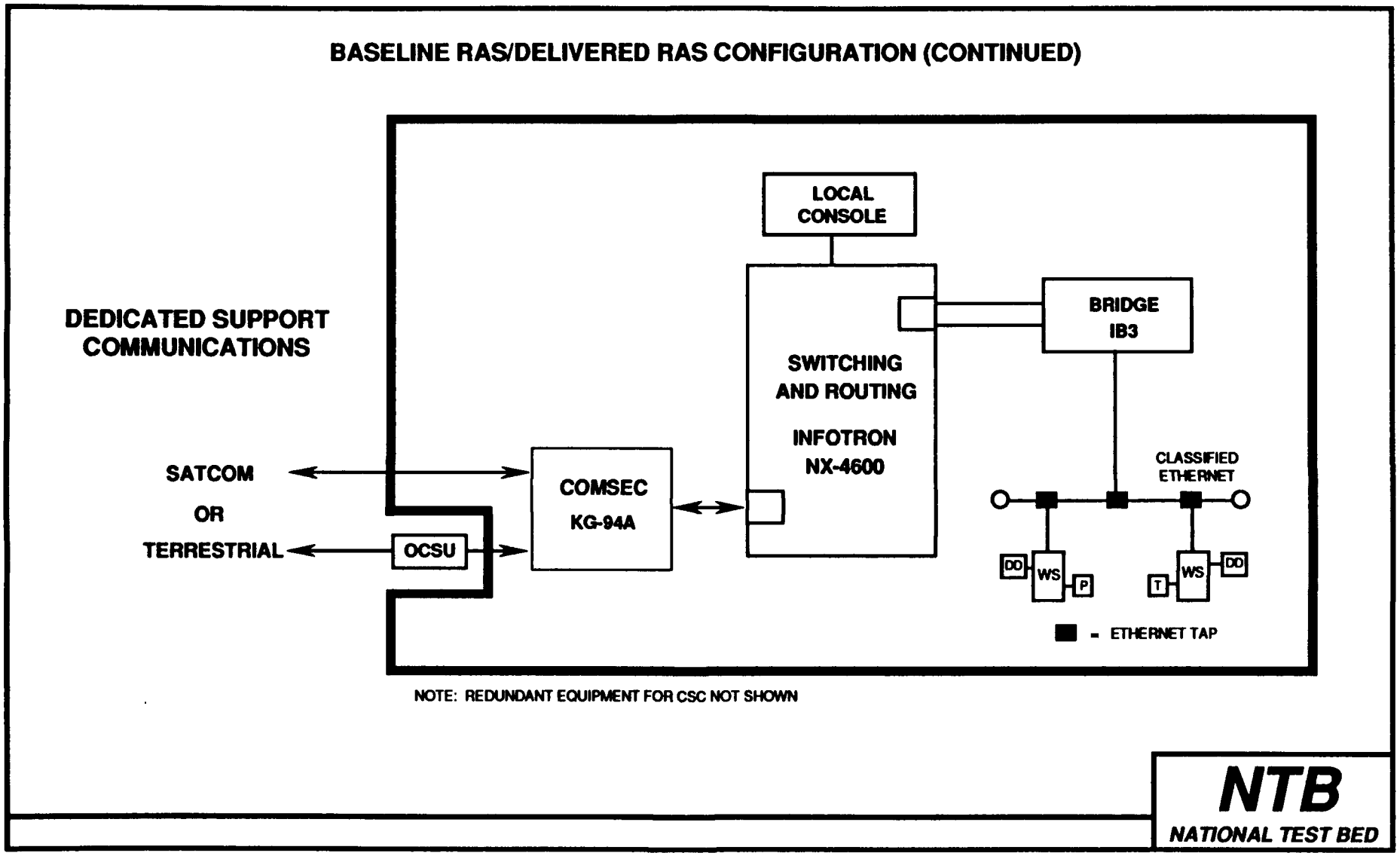


Figure 1.4-12

TYPICAL REMOTE SITE EQUIPMENT

a typical site. Figure 1.4-13 illustrates the types of Remote Access Set configurations.

1.4.2.1 Air Force Space Technology Center

AFSTC will be linked to the NTF by terrestrial lines. The customer service unit (CSU) will be installed in Building 498. A fiber optic Inter Facility Link (IFL) will be used between Buildings 498 and 402, with a fiber optic multiplexing unit at each location. The KG94As (crypto devices), 28-volt power supplies, and Clear Channel Units (CCU) are to be installed in Building 402. The KG94As are installed in the existing crypto rack. The NX4600 (a unit which performs data multiplexing and switching of data and voice channels), hyperchannel, and Sun workstation equipment are to be installed in the computer room of Building 402. The terrestrial line demarcation point is in Building 402. The local telephone carrier is US WEST. (Information concerning local carriers is presented for each site, since their telephone lines will be used to connect sites with the NTF and/or each other.) AFSTC will provide temporary storage for the equipment to be installed in Building 402. NTBIC will provide an installation plan.

All interior conduit and cable runs will be furnished and installed by the NTBIC. The interior cable installation methods preferred by AFSTC are as follows: (1) power cables are to be routed in conduit on the concrete subfloor; (2) red (non-encrypted) cables are to be routed in conduit under the raised floor; (3) black (encrypted) cables are to lay directly on the concrete subfloor.

The T1 Service from Communications Transmission Inc. (CTI) will provide and install a power panel in Building 402, if needed, for primary power from the substation. The commercial power at AFSTC has no regulation (i.e., has not been run through a power conditioner) or UPS and experiences numerous power outages during electrical storms. The NTBIC will install 7.5 kvA Power Conditioning Equipment to support the communications equipment. The heating, ventilating, and air conditioning (HVAC) at AFSTC is adequate to support ambient air cooling of the NTBIC system equipment. A single point ground with resistance less than 5 ohms exists. The NTBIC tie with the existing AFSTC ground will be coordinated with Kirtland AFB Civil Engineering.

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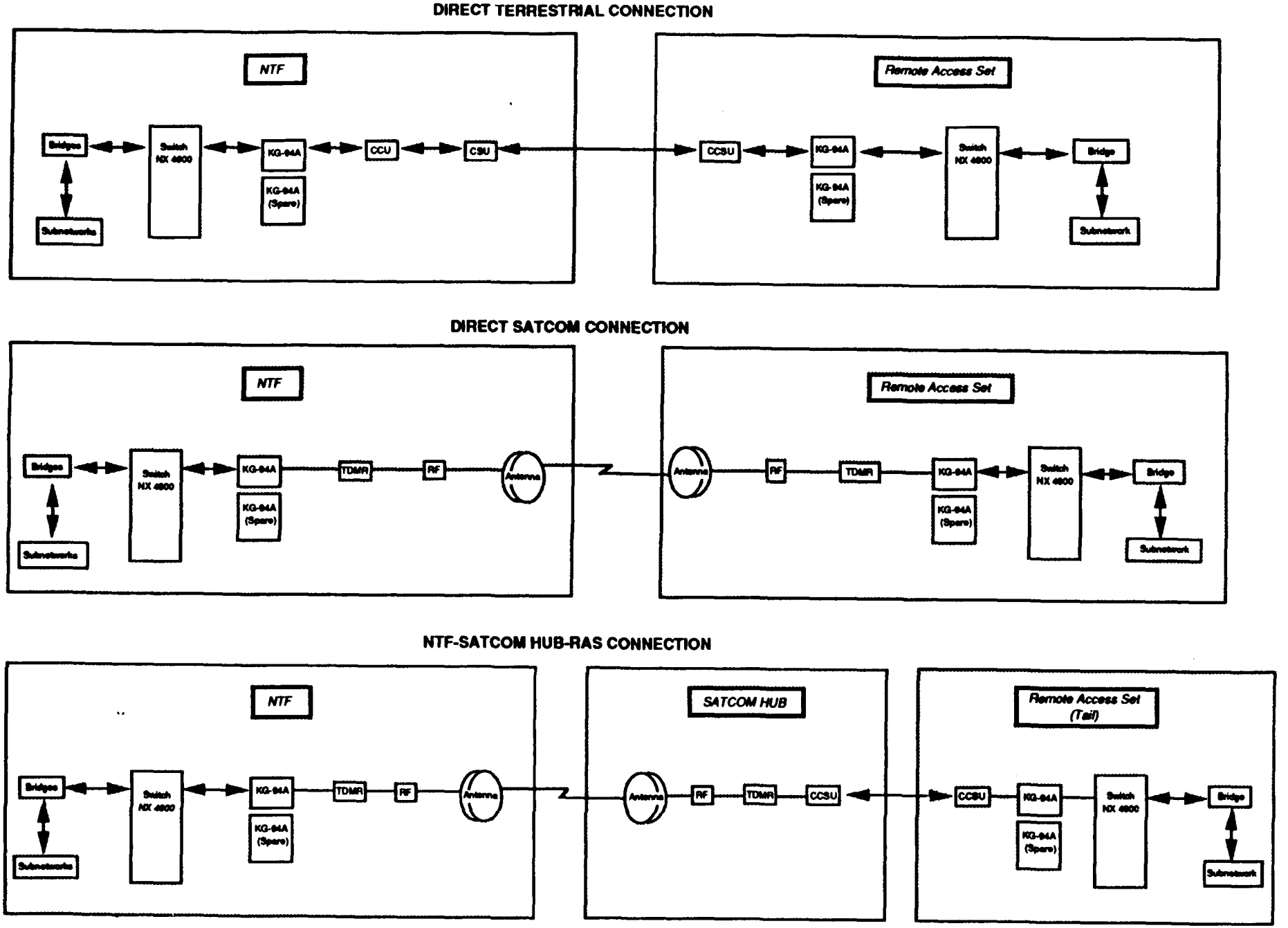

Figure 1.4-13

REMOTE ACCESS SET CONFIGURATIONS

1.4.2.2 Los Alamos National Laboratories

Terrestrial lines will link LANL with the NTF. The local carrier is US West. Spare capacity is available on the existing commercial input trunk. The demarcation point for the terrestrial lines is in the computer room in Room 220, Building 132.

No exterior cabling is required. All interior conduit and cable is furnished by the NTBIC and is installed by LANL. The cable installation methods preferred at LANL are (1) black cables placed on the base floor; (2) red cables placed in conduit; (3) red cables and conduit installed by LANL from the computer room in Building 132 to Building 332, Room 110; (4) power cables routed through conduit on the subfloor.

Sun workstations are placed in Room 105, Building 332, and Room 308 in Building 132. Communication Security (COMSEC) equipment (two KG94As and two power supplies) will be installed by LANL in the LANL crypto room in existing racks. The remaining equipment will be located in Room 220 of Building 132.

Circuit breaker panels, from which the equipment power is obtained, are located on walls in close proximity to the equipment serviced. LANL will not provide UPS. The NTBIC will provide conditioning and filtering for commercial power. The HVAC system is adequate to support ambient air cooling of the NTBIC system equipment.

A single point ground with resistance of less than 1 ohm exists. The NTBIC tie with this existing LANL ground was determined by LANL and will meet LANL security requirements.

The NTBIC will provide all equipment and materials, and LANL will be responsible for planning the equipment layout, placing equipment, and completing the installation of required cables. The NTBIC will connect and test the equipment.

1.4.2.3 U.S. Army Strategic Defense Command

The 7.3-meter antenna will be located approximately 240 feet north of the Colsa Building (see Figure 1.4-3).

The local telephone carrier is Southcentral Bell. The demarcation point for the terrestrial lines is in Room 509 in the Advanced Research Center (ARC). A cable trench is required from the antenna pad to the building penetration. Copper will be used for building penetrations. All interior conduit and cable runs are to be furnished and installed by the NTBIC. The SDC/Colsa-preferred interior cable installation methods are as follows: (1) plenum rated cable inside the building; (2) red cables routed in conduit; (3) black cables routed on the concrete subfloor; (4) power cables ro[illegible] in conduit.

KG94A equipment will be located in Room 614. The CSU, TDMA, and CT1000 equipment will be installed in Room 509. The NX4600 and system console will be installed in Room 613. One Sun workstation will be located in the Administrative Area; the other in the Management Information Center.

SDC black commercial power has UPS for Room 613. The red power regulation and distribution unit is located adjacent to the proposed equipment area in the computer room. Power conditioning is available for Room 509 and external power to the RF shelter and antenna will be supplied by NTBIC. The existing HVAC system is adequate to support ambient air cooling of the NTBIC system equipment. The area beneath the raised floor is pressurized by air handlers.

A single point ground is available at the electrical substation. The ARC building has a ground grid which will be utilized by the NTBIC for the NTBIC system equipment. Provisions must be made by the NTBIC for antenna grounding.

1.4.2.4 Electronic Systems Division

Terrestrial lines will link ESD with Spring Creek SATCOM Hub. The demarcation point for commercial terrestrial telephone lines is in Room 138 of the T-building. NYNEX is the local carrier.

The ESD/Mitre preferred interior cable installation methods are as follows: (1) cable routing will be the responsibility of the NTBIC; (2) all signal cables will be installed in conduit with red runs identified; (3) all cable routing and installation must be in accordance with local building codes.

All equipment will be located in Room 412 (the computer room) of the T-Building, in the corner closest to Room 302. Mitre will provide temporary storage for all NTBIC equipment.

Primary power must be routed by the NTBIC in conduit from the power conditioning unit provided by Mitre in the computer room to receptacle boxes under the raised floor. No UPS will be provided.

The existing HVAC system is adequate to support ambient air cooling of the NTBIC system equipment. The area under the 15-inch raised floor is pressurized by air handlers.

A single point ground exists and will be utilized by the NTBIC for NTBIC-provided equipment. The NTBIC will provide antenna grounding provisions.

1.4.2.5 Waldorf Microwave Space Research Facility (Naval Research Laboratory)

Antenna RF, TDMA and CCSUs will be located at a former Nike site near Waldorf, Maryland (see Figure 1.4-4). The main distribution frame in Building A49 at the NRL facility in Washington, D.C., 20 miles northwest, is fully utilized and has no lines available for the NTBIC. NRL will determine if the local carrier (Chesapeake and Potomac) can provide a new distribution panel to Building 54 in Washington, D.C.

1.4.2.6 Strategic Defense Initiative Organization

SDIO will be linked by T1 service to Waldorf SATCOM Hub. The local telephone carrier is Chesapeake and Potomac. The demarcation point for the terrestrial lines is in the computer room (1E-1041) of the Pentagon. No exterior cabling will be required. All interior cables will be furnished and installed by the NTBIC. The SDIO-preferred interior cable installation methods are as follows: (1) power cables are routed from distribution panels to equipment under the floor in conduit, with receptacle boxes located on grid; (2) black cables will be routed in existing conduit; (3) red cables will be exposed in trays in equipment areas; (4) area is secure secret with open storage provisions; (5) ethernet backbone (cable) will be installed from the projection room to Room 1E149; (6) cables are to be individually shielded; (7) cables to the Sun workstations will be in existing 4-inch conduit; and (8) conduit will be routed above the lowered ceiling in the halls.

A standard single point computer room ground is available and will be utilized by the NTBIC for NTBIC system equipment.

1.4.2.7 Rome Air Development Center

RADC will be linked by T1 service to Spring Creek SATCOM Hub. RADC will provide terrestrial circuits to the intermediate distribution frame in the area of equipment. New York NEX is the local carrier.

All required conduit and cable will be furnished and installed by the NTBIC. The RADC-preferred interior cable installation methods are as follows: (1) external to the equipment room, the cables will be installed in existing raceways and cable trays; (2) all cables will be installed under the raised floor in the equipment room; (3) separate red and black cable runs will be necessary; (4) red cables will be installed in conduit.

All equipment (except the Sun workstations) will be installed in Building 3 inside the Command and Control Technology Laboratory in the COMSEC room. Sun workstations will be installed in the room adjacent to the COMSEC room. RADC-provided equipment racks will be utilized for the installation of KG94As and power supplies. The NTBIC will provide an installation plan. KG94As and power supplies will be mounted in existing RADC equipment racks.

RADC will not provide UPS. Filtered commercial power is available for all equipment, and RADC will provide power outlets at all inside equipment locations. The HVAC system is adequate to support ambient air cooling of the NTBIC system equipment. A single point ground with a resistance of less than 1.5 ohms exists at the substation and will be utilized by the NTBIC.

1.4.2.8 Fillmore SATCOM Hub

An existing antenna at Fillmore, California will interface with SSD by a T1 link provided by the NTBJPO through commercial carrier (Pacific Bell).

1.4.2.9 Naval Research Laboratory, Washington, D.C.

Equipment to be located in Building 54, Room 129 at NRL, Washington, D.C. includes 1 NX-4600 switch, 1 NX SYS console, 1 IB/3 bridge, 2 CSUs, 1 crypto safe, 2 KG94As, and 2 Sun workstations. TDMA, Antenna, RF and CCSUs are installed at the Waldorf Facility. COMSEC equipment and material will be located in a vaulted area. NRL (Washington, D.C.) will provide temporary storage for the NTBJPO system equipment.

All interior conduit and cables will be furnished and installed by the NTBIC. The NRL-preferred interior cable installation methods are as follows: (1) cables in Building 54 are to run in overhead conduit to screen room penetration; (2) there are no shielding requirements for cables inside the screen room; (3) power cables must be routed in conduit.

NRL commercial power has no regulation or UPS. Initial evaluation of Room 129 indicates that existing electrical and HVAC systems are adequate for ambient air conditioning of the NTBIC system equipment. NTBIC will provide power conditioning equipment for communications equipment.

NRL has a multiport ground system. A single point ground system must be provided by NTBIC for the NTBIC system equipment. NRL provides COMSEC custodian and keys the KG94A. NRL requires two-person security control, a "no-lone" system whereby a minimum of two persons must be present at all times.

1.4.2.10 Space System Division

SSD will be linked by T1 service to Fillmore SATCOM Hub. The demarcation point for the terrestrial lines will be in the room adjoining the TEMPEST room in Building 80. A short length of fiber optic is required for penetration into the TEMPEST room in Building 80. All interior conduit and cable runs are furnished and installed by the NTBIC The SSD preferred interior cable installation methods are as follows: (1) cables will be installed in conduit with overhead runs; (2) all cables/conduit will be run down interior walls to reach equipment; (3) power cables must be installed in conduit.

The new TEMPEST room in Building 80 (HP 3000 Facility) will be used for all NTBIC equipment. Equipment layout will be coordinated with SSD. SSD will not provide UPS. Unregulated commercial power is available in the TEMPEST room. The HVAC system is adequate to support ambient air cooling of the NTBIC system equipment. Grounding is to be coordinated with SSD. Crypto equipment will be installed in a safe and collocated in the TEMPEST room with the communications equipment.

1.4.2.11 Foreign Technology Division

Ohio Bell is the local carrier and will deliver all terrestrial circuits to the equipment room. Its service currently consists of copper wire, which is scheduled for replacement with fiber optic cable by the end of 1989.

No exterior cabling will be required. Interior conduit and cable will be furnished by the NTBIC as required. The FTD-preferred interior cable installation methods are as follows: (1) red and black installation must be in accordance with standard isolation criteria; (2) all cables must be shielded inside the Specially Compartmented Information Facility (SCIF); (3) red cables must be installed in conduit; (4) FTD will instruct the NTBIC on the proper method of cable identification.

Equipment location is to be determined. FTD-provided power is unfiltered and has no UPS. The existing HVAC system is adequate to support ambient air cooling of the NTBIC system equipment. The crypto room (Room 216) has a single point ground.

1.4.2.12 General Electric Systems Engineering and Integration Facility

GE will be linked by T1 service to Spring Creek. The local telephone carrier is Chesapeake and Potomac. The demarcation point is a telephone switch room on the fourth floor of the GE facility. Interior cabling from the telephone switch room to the file server room on the third floor is to be procured and installed by GE. Cable specifications, conduit installation, and connection will be the responsibility of NTBIC. The file server room is a red (classified) area. Power is routed under an 8-inch raised floor; data lines are carried in cable trays near the ceiling.

CSUs are to be installed in the fourth floor telephone switch room, and other equipment will be installed in the third floor file server room. The GE facility is served by standard commercial power; however, the equipment will be run on GE's filtered power. No UPS is available. The HVAC system is adequate. Each receptacle will be individually grounded to a power panel. There is no isolated ground.

GE will provide a local net with Sun workstations; therefore, the Sun workstations normally provided with the remote access set are not required; however, a router to connect the two networks is provided by the NTBIC.

1.4.3 Construction, Installation, and Check-out

Information concerning the schedule for construction, installation, and check-out of the network will be presented in this section when available. Information concerning personnel involved in each place will be presented, as well, along with a general description of each task to be performed.

1.4.4 Operations and Maintenance

Operation of the NTB network will include executing computer software and communication simulations related to BM/C^3 systems between remote access sites and the NTF. The NTF will facilitate computer access throughout the network on a 24-hour per day basis. A schedule of simulation activities will be provided by the NTF through an electronic menu. Each remote access site will check the simulation menu to determine if participation in the scheduled activity is warranted. Each activity will occur from eight to 24 hours per day, depending on the scope of the SDI simulation. The number of SDI simulations per year has yet to be determined.

Currently planned experiments are summarized below:

The SDIO Phase One Program Management Office has identified an integrated experiment program, commonly referred to as the "Stellar" program, to focus on the resolution of key Command and Control(CC)/System Operation and Integration Functions issues. The Stellar program consists of nine distinct activities:

a. Signature and Background Data Collection. This activity calls for the NTBJPO, as a minimum, to maintain a "Yellow Pages" pointing to the location of the experiment results and briefly describing the experiment itself. This will be a software database residing on the NTF computers and accessible from the RASs.

b. Command Centers. This activity calls for the War Gaming and Early Command Center Experiment to resolve some early CC issues and to

provide guidance to the Pilot Command Center Program which will follow.

c. End-to-End Simulation. The End-to-End Simulation experiment activity covers the generation of threat tapes traceable to the official threat specifications and the performance evaluation of the Strategic Defense System (SDS) against those threats. The tape generation is performed within the NTF computer complex.

d. Tracking Algorithms Testbed. The objective of the Tracking Algorithms Testbed activity is to provide a detailed, high-fidelity, unbiased environment in which candidate algorithms can be tested, analyzed, and evaluated, leading to a tracking and discrimination algorithm which will meet the SDS BM/C^3 requirements. The Testbed will consist of a software "framework" and several software simulations, resident on NTF computers.

e. Distributed Multinode Network Test Bed. TBD.

f. Battle Planning Execution/Weapons Algorithms Test Bed. TBD.

g. Integrated System Demonstration. TBD.

h. System Emulation. TBD.

i. SDS Development Laboratory. TBD.

The NTB communications network is designed with redundancy in much of the system to allow for uninterrupted operation in the event of a component failure. System performance at each remote access site will be monitored through the NTB on a 24-hour basis for the purpose of locating failed components. Maintenance will be performed on an on-call basis.

A detailed operations and maintenance plan for the program is currently being developed.

1.4.5 Decommissioning

No specific operational life has been determined for the communications network. The system is intended to remain operational as long as needed. Decommissioning of the system, therefore, is not expected in the near future.

1.5 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

1.5.1 Land Lines

The only alternative means of connecting the NTF with remote stations would be through the exclusive and/or continued use of leased land lines. This alternative was rejected, however, because land lines alone could not carry sufficient information, because the antenna system offers greater reliability and repeatability, and because it would be less costly over the life of the project.

1.5.2 No-Action Alternative

The no-action alternative would not provide the communications capabilities necessary for the SDIO and NTBJPO to independently integrate and evaluate key technologies and alternative architectures. This would prevent an informed decision regarding full-scale development of the SDI.

Abbreviations

AFB	Air Force base
AFSTC	Air Force Space Technology Center
AFWL	Air Force Weapons Laboratory
ANSI	American National Standards Institute
ARC	Advanced Research Center
BM/C^3	Battle Management/Command, Control, and Communications
BSTS	Boost Surveillance and Tracking System
COMSEC	communications security
CSU	customer service unit
DAB	Defense Acquisition Board
DOD	Department of Defense
DOPAA	description of the proposed action and alternatives
ECAC	Electromagnetic Compatibility Analysis Center
EIAP	Environmental Impact Analysis Process
ERIS	Exoatmospheric Reentry Vehicle Interceptor System
ESD	Electronic Systems Division
FTD	Foreign Technology Division
GE	General Electric Systems Engineering and Integration Facility
GHz	gigahertz
GSTS	Ground-Based Surveillance and Tracking System
HVAC	heating, ventilating, and air conditioning
IRPA	International Radiation Protection Association
kW	kilowatts
LANL	Los Alamos National Laboratory
mps	megabits of information per second
mW/cm^2	milliwatts per centimeter squared
NCRP	National Council on Radiation Protection
NRL	Naval Research Laboratory
NTB	National Test Bed
NTBIC	National Test Bed Integration Contractor
NTBJPO	National Test Bed Joint Program Office
NTF	National Test Facility
OSHA	Occupational Health and Safety Administration
RADC	Rome Air Development Center
RF	radio frequency
SBI	Space-Based Interceptor
SCIF	Specially Compartmented Information Facility
SDC	U.S. Army Strategic Defense Command
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SDS	Strategic Defense System
SSD	Space Systems Division
SSTS	Space-Based Surveillance and Tracking System
TDMA	time division multiplex access
TVE	technology validation experiment
UPS	uninterrupted power supply